Remarks and Arguments

Claims 2-6, 8-14 and 21-27 have been elected for prosecution. By this response, claims 18-20 and 27 have been canceled. As a result, claims 2-6, 8-14 and 21-26 remain in the application.

Rejection Under 35 USC § 101

The rejection of claim 27 has been rendered moot by its cancellation.

Rejections Under 35 USC § 102

Claims 2-6, 8-14 and 21-26 stand rejected under §102(b) as being anticipated by Medard, U.S. Patent No. 6,047,331 (hereafter "Medard.") The Examiner contends that Medard discloses all of the claimed limitations.

The present invention relates to routing tables that determine data transmission paths in a switched network comprised of nodes connected by links. A routing table, as used in the invention, includes a row for every node in the network when that node acts as a data source and a column for every node in the network when that node acts as a data destination for a corresponding data source. Each table entry identifies a link that is part of a deadlock-free path that can be used to connect the source node associated with the entry row to the destination node associated with the entry column. Deadlock can occur, for example, when a group of switches, each of which has buffers full of received data, cannot pass on, nor receive, data. The deadlock occurs because the switches are not permitted to drop data packets and each switch cannot forward its data because the next switch also has full buffers.

In one aspect of the present invention, the routing table is derived by first determining an ordered set of deadlock-free sub-topologies of the network with each sub-topology comprising links not used in another sub-topology. This ordered set is then used to find a deadlock-free set of paths through the network which is represented by the entries in the routing table.

Another aspect of the present invention concerns the addition of a new node to the network in such a manner that the routing table will be changed as little as possible and so that the resulting network will also be deadlock-free. In particular, in order to

add a new node, a row and column are added to the routing table. Each entry in the added row identifies a link that directly connects the new node to a neighbor node that can be connected, via existing deadlock-free paths described by the table, to a destination node associated with the entry column. Each entry in the added column identifies a link that can be used to connect a source node associated with the entry row, via existing deadlock-free paths described by the table, to a neighbor node that can be directly connected to the new node.

The present claims particularly recites these aspects of the present invention. Claim 23, being representative, recites "forming an ordered set of deadlock-free sub-topologies" and "generating said routing table as a function of said ordered set of deadlock-free sub-topologies," and "adding to the routing table, a row including a plurality of entries, each entry identifying a link that directly connects the new node to a neighbor node that can be connected, via existing deadlock-free paths described by the table, to a destination node associated with the entry column; and adding to the routing table a column including a plurality of entries, each entry identifying a link that can be used to connect a source node associated with the entry row, via existing deadlock-free paths described by the table, to a neighbor node that can be directly connected to the new node." Further, the paths defined in the routing table continue to define deadlock-free paths in the network after addition of the row and column for the new node.

Medard is concerned with generating multiple topologies for each node in the network so that each node remains connected in the event of a failure of a node or an edge. (Abstract). Medard intends to provide a recovery mechanism upon detection of a failure in the network. (Abstract). In this type of network, avoiding deadlock is not an important consideration, in fact, Medard never mentions this term.

In Medard, a pair of tree topologies, each including a primary and a secondary topology, is computed for each node. Once these pairs of topologies are calculated, the path information is stored in a routing table. The topologies are stored in the routing table in a particular primary order and a particular secondary order so as to define the primary and secondary topologies. As a result, each source node is provided with a primary path and a secondary path to every other node in the network. (Col. 9, line 66 – Col. 10, line 19). In an event of a failure of a node or link in the network, the information

concerning the nodes and links and preferred paths among the nodes, stored in the routing table, can be accessed and used to re-route the signals through the secondary paths. (Col. 10, lines 19-27).

Medard teaches that the primary and secondary topologies are calculated by gathering the node topology of the network. (Col 11, lines 30-32.) Once the network node topology is known, then information regarding connections between nodes, such as, known or expected demand for traffic, cost of installation or maintenance of an edge, component availability, load balancing, and the like, are retrieved and exchanged between the nodes. (Col. 11, lines 42-52.) Once each node has the necessary information, then redundant tree topologies for each node are determined where each node considers itself a source and all other nodes to be included in the tree topology are considered as possible destinations. (Col. 12, lines 15-22.) Once again, there is no reference to maintaining a deadlock-free network.

While Medard does not explicitly describe the mechanism for adding a new node to the network, one of ordinary skill in the art would understand that a recalculation of the primary and secondary topologies for each node would be performed. It is reasonable to expect that such recalculation would be necessary in the event of either adding or removing nodes and/or edges from the network because of the change to the network topology and the effects on primary and secondary calculations. Such a recalculation could be triggered by a central management system.

In contrast to Medard, claim 23 recites "forming an ordered set of deadlock-free sub-topologies" and "generating said routing table as a function of said ordered set of deadlock-free sub-topologies," and "adding to the routing table a column including a plurality of entries, each entry identifying a link that can be used to connect a source node associated with the entry row, via existing deadlock-free paths described by the table, to a neighbor node that can be directly connected to the new node," and wherein "the paths defined in the routing table continue to define deadlock-free paths in the network after addition of the row and column for the new node."

In order for a reference to anticipate a claim, each and every limitation of the claim must be disclosed in the reference. Applicant respectfully submits that Medard does not accomplish this.

Medard does not disclose forming an ordered set of deadlock-free sub-topologies and generating the routing table as a function of the ordered set and Medard does not disclose addition, to a routing table, of a column with the recited entries, either explicitly or inherently, because Medard's routing tables and addition criteria are radically different from the tables and criteria disclosed in the instant specification. Finally, Medard does not disclose that the routing table continues to define deadlock-free paths after addition of the new row and column. As above, Medard is totally silent as to maintaining a deadlock-free network and does not teach nor suggest the routing table as recited in claim 23.

The Examiner points to column 9, line 44 – column 10, line 19 and Figure 1 as disclosing the claimed steps. However, the cited section of Medard describes the general concepts as already set forth above, i.e., the determinations of the primary and secondary topologies for each node with no discussion as to avoiding deadlock. Medard does not teach the particular method of generating and updating the table as claimed in claim 23. Applicant respectfully submits that the cited parts of Medard do not disclose the claimed invention and claim 23 patentably distinguishes over the cited reference.

In Medard, the routing table is generated to reflect the determined primary and secondary routing topologies as described above. Medard does not disclose forming sub-topologies in which links used in one sub-topology are not used in other sub-topologies and forming a spanning layer for the network. The Examiner points to Medard, column 10, lines 42-50 as disclosing forming a set of sub-topologies. This section of Medard, however, merely describes the routing table with respect to, once again, the primary and secondary paths and does not discuss sub-topologies with unique links as recited in claim 23.

Claims 3-6 and 21-22 are dependent, either directly or indirectly, on claim 23 and incorporate the limitations thereof. Therefore, these claims distinguish over Medard for at least the same reasons as submitted above with respect to claim 23. In addition, these claims recite further steps not taught in Medard.

Claims 3 recites forming an ordered set of deadlock-free sub-topologies of said network where one layer is a spanning layer of the network where each sub-topology

comprising links that are not used in any other sub-topology; and generating the routing table in response to the ordered set of deadlock-free sub-topologies.

The Examiner points to Medard, column 11, lines 38-58, as disclosing the formation of a spanning layer for the network. This section of Medard, however, discloses the determination of the primary and secondary networks, described above, and does not discuss spanning layers are recited in claim 3. Thus, for at least the foregoing reasons, Applicant respectfully submits that claim 3 patentably distinguishes over the Medard reference.

Claims 24, 25, 26 and 27 contain limitations that parallel those in claim 23 and, accordingly, distinguish over the cited Medard reference in the same manner as claim 23 as discussed above.

Claims 9-12 contain limitation that parallel those in claims 2-6 and distinguish over the cited reference in the same manner as claims 2-6.

Claims 13 and 14 are dependent, either directly or indirectly, on claim 24 and incorporate the limitations thereof. Therefore, they distinguish over the cited Medard reference in the same manner as claim 24.

In light of the foregoing amendments and remarks, this application is now believed to be in condition for allowance and a notice of allowance is earnestly solicited. If the Examiner has any further questions regarding this amendment, he is invited to call applicants' attorney at the number listed below. The Examiner is hereby authorized to charge any fees or direct any payment under 37 C.F.R. §§1.17, 1.16 to Deposit Account number 02-3038.

Respectfully submitted,

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